

## Finishing Lambs and Goat Kids on Pasture

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### Abstract

Producing goats and lambs for ethnic markets offers an economic opportunity for small farm producers in the Appalachian Region of the U.S. There are a variety of forages used in goat and sheep production systems. Overall, nutrients available to ruminants depend upon the types and combinations of plant resources grown. Weaned goat kids require 65-68% total digestible nutrients (TDN) and 12-14% crude protein (CP) in the diet while weaned lambs require 75-81.8% TDN and 14.5-16% CP in their diet. Rotational stocking of livestock on paddocks can improve forage use, maintain plant persistence and productivity, and provide a high nutritive value forage (especially TDN and CP) for finishing goats and sheep on pasture. When finishing goat kids and lambs on pasture, producers can maintain low production costs and have options to sell animals at different times and at a variety of weights that will satisfy niche markets. Meat packers who supply meats to ethnic markets typically desire healthy goat kids and lambs under 1 year of age and weighing 60 –70 pounds without excessive fat. Other sectors of the market desire younger animals weighing 25-50 pounds. Research at AFSRC in 2007 indicated that goats finished on alfalfa (*Medicago sativa* L.), red clover (*Trifolium pratense* L.) or orchardgrass (*Dactylis glomerata* L.) produced desirable body weights and carcasses for ethnic markets. Katahdin lambs and Boer x Kiko meat goat kids finished on an orchardgrass-red clover-white clover (*Trifolium repens* L.) pasture with and without whole cottonseed (*Gossypium hirsutum* L.) supplementation produced desirable body weights and carcasses for ethnic markets. Heavier weight (> 80 lbs) Suffolk lambs finished on pasture with and without supplementation may fit better into the traditional or Kosher meat markets. Also in this study, the number of anthelmintic doses administered for control of the gastrointestinal parasite *Haemonchus contortus* was reduced 38% when using the FAMACHA<sup>®</sup> system.

## **Background**

Meat goat, hair sheep, and traditional sheep industries are a vibrant component of small farm production systems in the Appalachian Region. These systems help produce meats to satisfy the demand from the expanding ethnic markets in the U.S, including Middle Eastern, Hispanic, European, African, and Caribbean cultures. Producing fresh meats for ethnic markets offers an income generating opportunity for small farms. The viability of any livestock enterprise is depends on minimizing production costs while producing a consistent and desirable product.

## **Small Ruminant Breeds**

Interest in meat goat production has increased since the introduction of the Boer meat-type goat from South Africa into the U.S. about 20 years ago. Goats in the U.S. prior to this time were Spanish-type goats, mostly decedent from dairy goat breeds. The Kiko, a meat-type goat from New Zealand, was introduced into the U.S. about 10 year ago and is gaining popularity in the southeastern U.S. (Browning et al., 2006) because of the breed's hardiness, survivability, low maintenance input, maternal traits, fast growth, and resistance to gastrointestinal parasites.

Traditional meat-type sheep breeds in the U.S. include Suffolk, Hampshire, and Dorset. Wool-type breeds include: Merino, Columbia, and Rambouillet. In recent years, interest has centered on the production of hair sheep because these sheep do not need to be sheared and have resistance to gastrointestinal parasites (Burke and Miller, 2004; Jones, 2004). Hair sheep breeds include: Katahdin, Dorper, and St. Croix.

## **Ruminants**

Goats, sheep and cattle are ruminants, which means each species has a four-compartmented stomach (rumen, reticulum, omasum, and abomasum), each with a specialized purpose that enables these species of livestock to thrive on grasses, legumes, forbs (weeds and herbs), and browse (woody plants, shrubs, vines, brambles, and trees) via microbial fermentation in the rumen.

## Forages

Forage is a general term that includes herbages, forbs, and browse. Herbages are grasses and grass-like plants (does not include the grain). Forbs are broadleaf plants that include legumes, herbs, and weeds. Legumes are considered a separate specialized group of forbs. Browse is defined as leaf and twig growth of shrubs, woody vines, trees, cacti, and other non-herbaceous plants.

There are a variety of forages used in goat and sheep production systems. In the Appalachian Region traditional cool-season grasses include orchardgrass (*Dactylis glomerata* L.), tall fescue (*Festuca arundinacea* Schreb.), bluegrass (*Poa pratensis* L.), and traditional legumes include white clover (*Trifolium repens* L.), red clover (*T. pratense* L.) and alfalfa (*Medicago sativa* L.). Non-traditional forages are used during summer and late fall to fill voids when traditional forages are less productive. Non-traditional forages include: warm-season grasses such as bluestems (*Andropogon* spp.), switchgrass (*Panicum virgatum* L.) and corn (*Zea mays* L.); summer annual grasses such as pearl millet [*Pennisetum glaucum* (L.) R. Br.], sorghum (*Sorghum* spp), crabgrass (*Digitaria sanguinalis*); legumes such as sericea lespedeza [*Lespedeza cuneata* (Dum. Cours.) G. Don] and annual lespedezas (*Kummerowia* spp); and forbs such as chicory (*Cichorium intybus* L.). Browse plants such as multiflora rose (*Rosa multiflora* Thunb.), yellow honey suckle (*Lonicera flava* Sims), autumn olive (*Elaeagnus umbellata* Thunb.) can also be utilized during this summer period. Fall grazing includes: annual ryegrass (*Lolium multiflorum* Lam.); forage brassicas (*Brassica* spp. including turnips, rape, and kale); and winter annual cereals such as wheat (*Triticum aestivum* L.), rye (*Secale cereale* L.), and triticale (*xTriticosecale rimpaui* Wittm.).

## Forage Nutritive Value

Overall, nutrients available to ruminants depend upon the types and combinations of plant resources. Traditional assessment of plants for nutritive value includes laboratory analyses for energy [usually expressed as total digestible nutrients (TDN)]; crude protein (CP)]; digestibility [in vitro organic matter disappearance (IVOMD)]; neutral detergent fiber (NDF) and acid detergent fiber (ADF)]; fats; minerals; and vitamins.

Weaned goat kids require 65-68% TDN and 12-14% CP in the diet which represents a TDN:CP ratio range of 4.9-5.4. While weaned lambs require 75-81.8% TDN and 14.5-16% CP in their diet which represents a TDN:CP ratio range of 5.1-5.2. Older, mature does and ewes have lower dietary requirements.

Browse such as honeysuckle can supply 72% TDN and 16% CP for goats and sheep. Turner and Foster (2000) reported that while CP and IVOMD concentrations in autumn olive, Morrow's honeysuckle (*Lonicera morowii* Gray), and multiflora rose were variable over the growing season, these plants were considered of high nutritive value for goats. When averaged across the growing season, CP was 26.5% (autumn olive), 16.7% (multiflora rose), and 14.5% (Morrow's honeysuckle) while IVOMD was 63.2% (autumn olive), 67.0% (multiflora rose), and 68.5% (Morrow's honeysuckle).

Cool-season grass pastures and hays (such as tall fescue, orchardgrass, Kentucky bluegrass) typically supply 58% TDN and 12% CP while legume pastures and hays (alfalfa, red clover, white clover) can supply 62% TDN and 18% CP. Orchardgrass pasture maintained in a vegetative stage (boot stage to early bloom) can supply 65% TDN and 18% CP whereas a more mature sward (more seed head) supplies 50% TDN and 8% CP. Maintaining plants in vegetative stages as compared to more mature stages (seed head) can be accomplished with grazing management practices.

### **Intensive Grazing Management**

Grazing allows the animals to harvest the forage and is usually cheaper than feeding purchased hays. Intensive management generally involves a grazing plan that synchronizes duration of the grazing interval with the growth characteristics of the plant stand, by moving or adjusting the number of grazers on a given land area. Intensive grazing management can maintain plant persistence and productivity, and high nutritive value, especially TDN and CP, for improved forage utilization by grazing livestock. Producers can couple different methods of stocking for successful forage management and improved animal production. Many producers have implemented rotational stocking of livestock on pastures to improve overall forage utilization to achieve more uniform distribution of fecal and urinary nutrients for plant growth.

With rotational stocking, a large pasture is typically divided into smaller grazing areas termed paddocks, then a specified number of livestock are allotted to the first paddock, allowed to graze for a period of time, moved to the second paddock, and so on throughout the grazing season. With this type of management, paddocks are rested which allows forages time to regrow. This system helps to maintain forages with high nutritive value for sheep and goats, especially for finishing weaned kids and lambs which have higher nutrient requirements compared to mature animals.

### **Markets for Goats and Sheep**

For traditional markets, lambs have been finished to 90-120 lbs. Meat packers supplying meats to ethnic markets (especially Halal) typically desire healthy goat kids and lambs under a year of age and weighing 60 –70 pounds without excessive fat. Other sectors of the ethnic markets desire younger animals weighing 25-50 pounds. With the dressing percentage around 50%, these weights of live animals produce carcasses weighing 15-35 pounds. Many ethnic groups traditionally purchase a whole carcass.

Producers have the option of selling goats and sheep at lighter weights to satisfy the needs of ethnic markets, local specialty meat markets, local restaurants, custom BBQ shops, or individuals. Markets for goats include: suckling kid (4-6 weeks of age); weanling kid (4-6 month of age); barbequing kid (6-12 month of age), and older animals (usually cull females). There are markets for young mature bucks.

Major ethnic meat markets are for Halal- or Kosher-harvested animals. These markets involve a religious ceremony associated with harvesting chevon, lamb, beef, or poultry for human consumption. Direct marketing of live animals for fresh meat is a niche opportunity for farmers in the USA.

### **Weight Gain and Carcass Parameters**

In general, forages are energy limiting and animals finished on pasture without energy supplementation gain weight slowly and produce leaner carcasses than animal finished in the feedlot on high grain diets. Site of fat deposition within the carcass and fat composition are related to the diet and breed of animal. Hair sheep (Horton and Burgher, 1992), and meat goats (Warmington and Kirton, 1990) yield lightweight carcasses with

less subcutaneous fat cover and more internal fat compared to traditional sheep breeds (i.e. Suffolk, Hampshire) of the same age. Ruminants grazing legumes often have higher liveweight gains compared to forage grasses (Karnezos et al., 1994). Feeding diets high in fiber resulted in slower goat growth rates compared to high concentrate diets (Mahgoub et al., 2005).

In pen feeding studies with Spanish kids offered grass or alfalfa hays and a corn-soybean meal supplement, Wildeus et al. (2007) reported that goat average daily gain, carcass weight, and dressing percentage increased as forage nutritive value increased (grass hay vs alfalfa hay). Wether goats had greater ribeye area than bucklings or doelings. Wethers also had greater back fat than bucklings; doelings were intermediate. Internal fat was highest in doelings, intermediate in wethers, and lowest in bucklings. In a second pen feeding study with Boer and Boer crossbred wethers, ADG and dressing percentage was higher for kids offered alfalfa hay plus supplement compared to grass hay plus supplement; there were no differences in other carcass characteristics.

### **ARS-AFSRC Research Summary**

Trial 1. Meat goats finished on alfalfa, red clover, or orchardgrass pasture.

In 2007, seventy-two growing meat goat wethers (at least 75% or greater Boer breeding) were randomly assigned to three pasture treatments: alfalfa, red clover, or orchardgrass that were each replicated three times, at a stocking density of 16 kids/ac (8 kids/pasture). Each pasture was 0.5 ac subdivided with electrical fencing into ten 0.05-acre paddocks for rotational stocking management based on a target 4-d occupation period.

Grazing began on 6 June and continued until 11 Sept 2007. Animals had access to water and mineral supplement at all times and were dewormed every 30 d with a combination (one from each anthelmintic class: benzimidazole, tetrahydropyrimidine and macrocyclic lactone) of orally administered anthelmintics.

At the end of the grazing season, animals were processed according to traditional Halal protocol. Carcasses were stored overnight for 12 hr in a walk-in cooler maintained at 34° F prior to recording carcass data. The ribeye area (REA) and backfat (BF) were recorded from the right and left sides of the carcass and averaged. Chilled carcass wt and

leg, lean quality, and overall conformation scores were recorded. Dressing percentage was calculated using the chilled carcass wt divided by final shrunk body weight (BW).

Table 1. Trial 1--Performance and carcass data when meat goat wethers were finished on alfalfa (ALF), red clover (RCL), or orchardgrass (OGR) pastures in 2007.

Item <sup>z</sup>	ALF	RCL	OGR	P value
Begin BW, lb	49.2	49.8	49.2	>0.10
Final BW, lb	63.7a <sup>y</sup>	59.9a	54.8b	<0.001
ADG, lb/d	0.22a	0.15b	0.13b	<0.001
Carcass Wt, lb	29.6a	26.5b	23.7c	<0.001
Dressing %	46.4a	44.2b	43.0b	<0.001
REA, sq. in.	1.40a	1.23b	1.13b	<0.001
BF, in.	0.07a	0.06b	0.05b	<0.01
Leg Score	10.4a	10.2a	9.6b	<0.001
Lean Score	11.0a	11.3a,b	10.7b	<0.05
Conformation Score	10.7a	10.5a	10.0b	<0.01

<sup>z</sup> BW = body weight; ADG = average daily gain; REA = ribeye area; BF = backfat.

<sup>y</sup>Means in the same row without common letters differ by the *P* value listed.

Final BW were greater for goats grazing alfalfa and red clover compared to those grazing orchardgrass (see Table 1). Overall ADG was greater for alfalfa compared to red clover and orchardgrass which were similar. Chilled carcass wt followed a trend of alfalfa > red clover > orchardgrass. Dressing percentage of red clover and orchardgrass was similar, and both were greater than alfalfa. The REA and BF thickness was higher for kids finished on alfalfa compared to red clover and orchardgrass. Leg score and conformation score followed a trend of alfalfa > red clover > orchardgrass; lean score was greater for alfalfa compared to orchardgrass; red clover was intermediate.

Trial 2. Traditional lambs, hair-sheep lambs and meat goats finished on pasture with and without supplementation.

A mixed sward of orchardgrass, red clover, and white clover was used for this experiment in 2007. Hay was harvested from all pastures in May 2007, and nitrogen fertilizer (33 lb N/ac) was broadcast after haying. The area was divided into six grazing pastures (each 1.5 acres) using electrical fencing; each of the six 1.5-acre pastures was subdivided into three grazing paddocks each containing 0.5 ac.

Thirty-six Suffolk crossbred lambs, 36 Katahdin lambs, and 36 Boer x Kiko meat goat kids were used. All kids and lambs were wethers of the same age (born 1-15 March 2007). Lambs and kids were weighed and assigned to six groups; each grazing group contained six Suffolk, six Katahdin, and six goat wethers. A group of lambs and kids grazed pastures together at a stocking density of 18 animals per 1.5-acre pasture (12 animals per acre). Each pasture was 1.5 ac in size and was subdivided into three 0.5-ac paddocks for rotational stocking management based on a target 21-d occupation period. Paddocks were mowed to a 4-in stubble height immediately after each occupation.

Three groups were supplemented with whole cottonseed (*Gossypium hirsutum* L.; WCS) at 0.5% BW daily throughout the experiment whereas the other three animal groups were not offered WCS supplement. Animals were weighed every 14 d, BW recorded, and supplement adjusted after each weigh day.

Grazing occurred from 29 June until 25 Sept 2007. Animals had access to water and salt-mineral supplement at all times and were dewormed only at the beginning of the study each year with a combination of orally administered anthelmintics (benzimidazole, tetrahydropyrimidine and macrocyclic lactone). After the initial deworming, only individual animals were administered anthelmintics when FAMACHA<sup>®</sup> eyelid score was 3 or greater; eyelid scores were determined every two wk.

Performance and carcass data are presented in Table 2. Overall as the season progressed, final BW and ADG were greater for WCS supplemented than unsupplemented animals and followed a trend of Suffolk > Katahdin > Goat. There were no treatment effects on carcass wt., dressing %, REA, BF, or leg, lean, or conformation scores. There was a breed effect on all parameters that followed a trend of Suffolk > Katahdin > Goat.



Table 2. Trial 2--Performance and carcass data when Suffolk (SX) lambs, Katahdin (KA) lambs and meat goat (GX) kids were finished on pasture with and without whole cottonseed supplement in 2007.

Item <sup>z</sup>	--No Supplement--			---Supplement---			Supplement <sup>y</sup>	Breed <sup>x</sup>
	SX	KA	GX	SX	KA	GX	Effect <i>P</i> value	Effect <i>P</i> value
Begin BW, lb	58.3	54.8	33.9	57.1	53.5	32.2	>0.10	<0.001
Final BW, lb	76.5	71.2	40.5	85.3	71.7	42.5	<0.01	<0.001
ADG, lb/d	0.20	0.18	0.07	0.32	0.20	0.12	<0.001	<0.001
Carcass Wt., lb	39.6	38.4	19.0	42.7	36.5	20.6	>0.10	<0.001
Dressing %	51.7	54.0	47.0	49.9	50.9	48.5	>0.10	<0.001
REA, sq. in.	1.92	1.72	0.97	1.97	1.70	0.99	>0.10	<0.001
BF, in	0.05	0.10	0.03	0.06	0.09	0.03	>0.10	<0.001
Leg Score	11.4	12.3	9.8	12.0	11.9	9.7	>0.10	<0.001
Lean Score	12.3	12.3	10.7	12.4	12.7	10.7	>0.10	<0.001
Conformation								
Score	11.3	12.1	9.8	11.9	11.8	9.7	>0.10	<0.001

<sup>z</sup>BW = body weight; ADG = average daily gain; REA = ribeye area; BF = back fat.

<sup>y</sup>Overall effect due to supplementation at *P* value listed; if *P* > 0.10, then not significant.

<sup>x</sup>Overall effect due to breed at *P* value listed.

Also in this study, the number of anthelmintic doses administered was reduced 38% when using the FAMACHA<sup>®</sup> system. Theoretically had the goats and lambs been dewormed every 30 days in July, August and September this would have resulted in a total of 324 doses of anthelmintic used. With the FAMACHA<sup>®</sup> system and administering dewormer only when individual animals scored a 3 or greater during this 90-d period, we used 200 doses of anthelmintic (104 doses in the unsupplemented groups and 96 doses in the supplemented groups).

## Summary

In our studies, goats finished on alfalfa, red clover, or orchardgrass produced desirable body weights and carcasses for the Halal ethnic market. Katahdin lambs and Boer x Kiko meat goat kids finished on pasture with and without whole cottonseed supplementation produced desirable body weights and carcasses for the Halal ethnic market. Heavier weight (> 80 lbs) Suffolk lambs finished on pasture with and without supplementation may fit better into the traditional or Kosher meat markets. The FAMACHA<sup>®</sup> system can be used to reduce the amount of dewormers administered to goats to effectively control barberpole worm (*Haemonchus contortus*).

## Current Research

In May 2009, a meat goat pasture finishing study was initiated. Meat goat wethers (avg initial wt 45 lbs) graze: 1) prairiegrass (*Bromus willdenowii* Kunth.) interseeded with red clover; 2) prairiegrass interseeded with birdsfoot trefoil (*Lotus corniculatus* L.); or 3) prairiegrass interseeded with chicory. Parameters currently being evaluated include: forage mass, forage nutritive value, goat body weight, average daily gain, blood parameters, FAMACHA<sup>®</sup> scores, fecal egg count, carcass parameters, and meat quality.

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